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UTILITY PATENT APPLICATION TRANSMITTAL <small>(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))</small>	Attorney Docket No	P112554
	First Inventor or Application Identifier	Alvin L. Neeley
	Title	MANHOLE COVER LIFTING APPARATUS AND METHOD
	Express Mail Label No.	EL372451820US

APPLICATION ELEMENTS <small>See MPEP chapter 600 concerning utility patent application contents.</small>		ADDRESS TO: Assistant Commissioner for Patents Box Patent Application Washington DC 20211	
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2. <input checked="" type="checkbox"/> Specification <small>[Total Pages 26]</small> - Descriptive title of the Invention - Cross References to Related Applications - Statement Regarding Fed sponsored R & D - Reference to Microfiche Appendix - Background of the Invention - Brief Summary of the Invention - Brief Description of the Drawings (if filed) - Detailed Description - Claim(s) - Abstract of the Disclosure	6. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary) a. <input type="checkbox"/> Computer Readable Copy b. <input type="checkbox"/> Paper Copy (identical to computer copy) c. <input type="checkbox"/> Statement verifying identity of above copies		
3. <input checked="" type="checkbox"/> Drawing(s) (35 U.S.C. 113) <small>[Total Sheets 7]</small>			
4. Oath or Declaration <small>[Total Pages 33]</small> a. <input type="checkbox"/> Newly executed (original or copy) b. <input checked="" type="checkbox"/> Copy from a prior application (37 C.F.R. § 1.63(d)) <small>(for continuation/divisional with Box 16 completed)</small> 1. <input type="checkbox"/> DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).			
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November 15, 1999
Docket No. P112554

Sir:

Transmitted herewith for filing is a Continuation patent application of:

Applicants: Alvin L. Neeley & Steven M. Davis
Title: MANHOLE COVER LIFTING APPARATUS AND METHOD

This Continuation Patent Application is claiming priority benefit of U.S. Serial Number(s) and Filing Date(s):

09/233,417	01/19/99
08/625,698	04/03/96
08/489,360	06/12/95

1. Enclosed are:

- a) **Certificate of Express Mailing requesting treatment under 37 CFR 1.10, Express Mail Filing Date of November 15, 1999, Label No. EL372451820US;**
- b) 1-page Utility Patent Application Transmittal;
- c) 1-page Fee Transmittal (original and a copy);
- d) 33-page Copy of Parent U.S.S.N. 09/233,417 (Specification, Claims, Abstract and Informal Drawings);
- e) 2-page Preliminary Amendment;
- f) 4-page Copy of Executed Combined Declaration and Power of Attorney from grandparent application (U.S.S.N. 08/625,698);
- g) 2-page Copy of Executed Verified Statement Claiming Small Entity Status (Independent Inventor) from grandparent application (U.S.S.N. 08/625,698);
- h) A check in the amount of \$380 for Filing Fee; and
- i) A stamped return receipt postcard.

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DATE MAILED: November 15, 1999

PATENT

Attorney's Docket No. P3526

Applicant or Patentee: ALVIN L. NEELEY et al

Serial or Patent No.: 0 / _____

Filed or Issued: _____

For: MANHOLE COVER LIFTING APPARATUS AND METHOD

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY
STATUS (37 CFR 1.9(f) and 1.27(b))—INDEPENDENT INVENTOR**

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled MANHOLE COVER LIFTING APPARATUS AND METHOD described in

- ☒ the specification filed herewith.
☐ application serial no. 0 / _____, filed _____
☐ patent no. _____, issued _____

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ no such person, concern, or organization
☐ persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27).

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I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of pay-

ing, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

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Alvin L. Neeley

Signature of Inventor

Date

1/4/96

STEVEN M. DAVIS

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Steven M. Davis

Signature of Inventor

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Date

PATENT
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Alvin L. Neeley et al.) Application Branch)
Filed:	11/15/99) Attorney's) Matter No:P112554
Title:	MANHOLE COVER LIFTING APPARATUS AND METHOD	

Assistant Commissioner of Patents
U.S. Patent & Trademark Office
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

On the first page of the application, at the top of the page under the title insert the following:

"This application is a Continuation of U.S. Patent Application S.N. 09/233,417 filed on 01/19/99, which is a continuation of S.N. 08/625,698 filed on 04/03/96 (now abandoned), which is a continuation of 08/489,360 filed on 06/12/95 (now abandoned)."

If there is any matter which could be expedited by consultation with the Applicants' attorney, such would be welcome. The Applicants' attorney can normally be reached at the telephone number below.

Signed at Bellingham, County of Whatcom, State of Washington this 15th day of November, 1999.

Respectfully submitted,

NEELEY ET AL.

By 

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MANHOLE COVER LIFTING APPARATUS AND METHOD

Background of the Invention

a) Field of the Invention

5 The present invention relates to an apparatus and method for lifting and removing larger and heavier objects which are at least moderately awkward to handle, and more particularly to such an apparatus and method for lifting and removing
10 manhole covers from a manhole frame, and accomplishing this in a manner to facilitate the process to avoid injury to workers.

b) Background Art

15 Manholes are commonly located at streets and other surface locations to provide access to some underground location, and these are commonly used in connection with utilities (power or communication lines, sewers, etc.). When a
20 workman travels to a site where some operation has to be for the utility, sewer, or other need, there is generally the preliminary task of removing the manhole cover, from the surface opening, and then replacing it.

25 There are various ways of accomplishing this, sometimes a crowbar-like tool is used to lift one edge of the manhole cover, after which a lever-like tool is used to lift it first vertically so that it is clear of the surrounding frame and then laterally.

30 The task of replacing the manhole cover is accomplished in somewhat the same manner.

Statistically, the task of removing and replacing manhole covers has been found to be a

high risk operation in terms of promoting and or causing back and other muscular-skeletal injuries. In spite of this, to the best knowledge of the applicant herein, there has not as yet been
5 devised a method and/or apparatus for removing manhole covers which has gained wide commercial acceptance, where the apparatus and/or method is effective and convenient, while providing little or substantially no risk of injury to the workers.

10 A search of the patent literature has disclosed a number of U.S. patents that deal with the problem of lifting manhole covers and the like, these are the following:

U.S. 4,181,290 (Affolter) shows a device for
15 lifting a manhole cover or other vault cover. There is a base comprising three legs extending outwardly from a center location. There is an upright post, and a lifting arm is connected to the center base portion of the three legs and also
20 is connected to the post. This arm is raised to lift the cover.

U.S. 4,488,706 (Kono) shows a manhole cover lifting device where there is a lever bar having a hook on the lifting end, and a rearwardly
25 positioned handle. The bar is supported by a pair of wheels at the lifting location. The hook end of the bar is secured to the cover, and the opposite end of the bar is pushed downwardly to lift the manhole cover, as the bar pivots on the
30 wheels which serve as a fulcrum.

U.S. 4,365,925 (Gritz) shows a manhole cover lifter which is similar to the above mentioned Kona patent. There is a bar 11 that is supported

by a set of wheels. One end of the bar is secured to the cover, and the other has a handle which is pressed downwardly to lift the manhole cover as the bar pivots on the wheels which serve as a
5 faucrum.

U.S. 4,321,003 (Cassel) shows what is called a "lifting tool" and shows an arrangement in which a pair of anti-friction bearings, as shown in
10 sheet 4 of the drawings of the patent, are secured to a elongate lift rod that clamps at each end to the vault cover. A handle is lifted to rotate the rod which is connected to the inner races of the bearings. These are rotated 180° so that the cover is raised high enough to be rolled on the
15 outer races of the bearings.

U.S. 4,746,098 (Abarotin) shows a manhole cover lifting device in which there is a bar that extends from a ground supported pivot 17 to a handle at the other end. There is a means to
20 attach the cover to the bar aligned on the center of the bar. In use the bar is secured to the cover and the handle end is lifted. The parts are pivoted on the member 17 so that the cover is swung out of the way.

U.S. 4,653,728 (Mochizuki) shows a manhole cover lifter where there is a pair of wheels, each of which is fastened adjacent to a grasping means. There are series of lever associated with the wheel mounts that enable the lifting and
25 maneuvering of the lid.
30

U.S. 4,662,607 (Mochizuki et al) shows a lifting device where there is an elongate bar mounted to ground wheels at a location near the

manhole the bar is used as a lever, with the wheels acting as a fulcrum to lift the manhole cover by the front portion of the bar.

U.S. 1,890,765 (Zent) shows an amusement park ride which in Figure 17 is shown as a car with wheels mounted at angles to each other.

Summary of the Invention

The lifting assembly of the present invention is arranged to lift an object which has a width dimension and it at least partially surrounded by a base surface which has a substantial horizontal alignment component. In the preferred embodiment, this object is a manhole cover (also called a vault cover) surrounded by a paved or ground surface. This lifting assembly is particularly adapted to enable the object (or manhole cover) to be lifted in a manner which substantially eliminates, or at least substantially alleviates, potential injury to a workman who is to remove the manhole cover.

The assembly comprises a base support assembly which in turn comprises a beam structure which has a lengthwise axis, is adapted to be positioned above the object, and has a lengthwise dimension greater than the width dimension of the object. The beam structure has a first pivot end and second mobile end.

The base support assembly also comprises a pivot support connected to the beam structure and located at the pivot end thereof. The pivot support is arranged to support the pivot end of the beam structure from the base surface.

5 The base support assembly also comprises a mobile support connected to the beam structure and located at the mobile end thereof. This mobile support is arranged to support the mobile end of the beam structure from the base surface. The mobile support has mobile base surface engaging means to enable the mobile support to be moved laterally over the base surface.

10 There is a lifting mechanism mounted to the base support assembly and comprises a lift connection to engage the object and an actuating means to lift the object.

15 Thus, the lift assembly can be positioned over the object with the pivot support being on one side of the object and the mobile support being on an opposite side of the object, so that the lifting mechanism is able to raise the object. The lifting assembly can then be moved laterally so as to move the object.

20 In the preferred form, the pivot support is arranged to engage the base surface in a manner to remain at a substantially stationary base surface location during movement of the lifting assembly. More particularly, the surface engaging means of the mobile support is arranged to move in an
25 arcuate path having the stationary location of the pivot support being at a center of said arcuate path.

30 In a preferred embodiment, the surface engaging means comprises a pair of base surface engaging wheels positioned on opposite sides of the mobile end of the beam structure. Each of the wheels has an axis of rotation, with the two axes

of rotation converging and meeting at substantially said location of the pivot support.

In the preferred form, the pivot support comprises a post extending downwardly from the pivot end of the beam structure, with a lower end of the post being adapted to engage the base surface.

In a preferred embodiment, the lifting mechanism comprises a lifting jack mounted to the beam structure at an intermediate location between the pivot end and the mobile end of the beam structure. In the preferred form, the jack has a substantially vertical lift axis, and the jack has a lifting member connected to a lower end thereof to said lift connection. The jack has actuating means to raise the lifting member relative to the beam structure. In a specific embodiment, the jack is a screw jack, comprising an actuating screw vertically align in the jack, and further comprising manually operable crank means to turn the actuating screw.

A preferred form of the lift connection comprises a pair collet fingers adapted to be positioned in a lift opening of the object. There is means to expand the collet fingers outwardly to come into gripping engagement with the surface of the lift openings.

Also, there is provided an auxiliary lift bar which has an auxiliary lift connection to lift the object at an off-center connecting location spaced from a center of gravity of said object. The lift bar has a lifting mechanism connecting portion adapted to be located near a center of gravity of

the object and be connected to the lifting mechanism near the center of gravity. The auxiliary bar has a torque portion spaced from said center of gravity location, the torque
5 portion has a torque member engaging said object at a location spaced from the off center connecting location to apply a torque from the auxiliary arm to said object so that said object is lifted entirely from said base surface.
10 Desirably, the lifting mechanism connecting portion has adjustable connecting means whereby said auxiliary lift bar is able to engage said object at various locations spaced from the center of gravity.
15 In the method of the present invention the beam structure is positioned over the object which is then lifted, as described above. The lifting assembly is moved laterally.
Other features will be apparent from the
20 following detailed description.

Brief Description of the Drawings

Figure 1 is an isometric view illustrating the apparatus of the present invention in its
25 operating position;

Figure 2A through 2C are side elevational views of the apparatus of the present invention operating to lift a manhole cover out of its perimeter mounting frame;

30 Figure 3A is a top plan view showing the apparatus in its position above a manhole cover to lift the manhole cover vertically;

Figure 3B is a top plan view similar to Figure 3A, but showing the manhole cover having been moved to a side location away from the manhole;

5 Figures 4A, 4B and 4C are top plan views showing different locations or patterns on the manhole cover for a access lifting opening or openings;

10 Figure 5 is an isometric view illustrating a first embodiment of a lifting attachment used to engage the manhole cover;

15 Figure 6 is a side elevational view showing the manhole cover in section, with the lifting attachment being positioned within the lift access opening of the manhole cover;

Figure 7 is a view similar to Figure 6, showing an expansion wedge inserted into the lifting attachment of Figure 6 to engage the manhole cover;

20 Figure 8 is an isometric view of an auxiliary lift bar of the present invention;

25 Figure 9 is a side elevational view, showing the manhole cover in section, with the auxiliary lift bar being positioned to lift the manhole cover which has an extreme off-center lift access opening;

Figure 10 is a top plan view of a manhole cover having a vented or grated surface with a plurality of openings over the entire surface;

30 Figure 11 shows a lift hook used for the manhole cover of Figure 10;

Figure 12 illustrates a manhole cover having a cross-finger in a recess which provides for lifting engagement;

Figure 13 is a side elevational view showing a lift hook member engaging the finger as shown in Figure 12;

Figure 14 is a longitudinal sectional view showing the screw jack that is used in the embodiment shown in Figure 1 to raise the manhole cover;

Figure 15 shows the apparatus of the present invention being positioned so that it can be rolled along a street or ground surface.

15 Description of the Preferred Embodiment

The apparatus 10 of the present invention is shown in Figure 1 in its operating position to lift a manhole cover 12 out of its surrounding support frame 14. More recently a "manhole cover" is often referred to as a "vault cover" or a "utility vault cover". It is to be understood that the term "manhole cover" also refers to these. This apparatus 10 comprises two main components, namely a lift support base assembly 16 and a lifting mechanism 18.

The base assembly 16 comprises three main components. First, there is a main lifting bar 20 which in the operating position of Figure 1 extends entirely across the manhole cover 12 so that both ends of the bar 20 extend beyond the perimeter 22 of the manhole cover 12. This bar 20 has a pivot end 24 and a mobile end 26. This bar functions as a beam structure and could also be

configured as a truss or other support member to transfer lifting loads from a central location out to the end locations.

5 The second component of the base assembly 10
is a pivot support provided as a post 28 having
an upper end 30 fixedly connected to the lift bar
20 and extending downwardly to its lower pavement
engaging end 32. (Since a manhole is generally
10 positioned at a paved location, such as in a
street, it will be assumed that the surface
surrounding the manhole frame 14 is the paved
surface 33.) The pivot support could in some
instances be structured so as to be able to move
laterally over the ground surface but functions in
15 most instances quite reliably by having ground
engagement at a single ground location where it is
able to pivot at that location. One advantage of
this is that it is easier for one man to remove
the cover by himself. also, with a stationary
20 pivot location, when the manhole cover is
replaced, the pivot post 28 keeps the position of
the cover 12 constant relative to the arcuate path
it travels to make it much easier to align the
cover 12 with the perimeter frame 14, thus
25 facilitating replacement.

 The third main component is a mobile support
member 34 which comprises a support post 36 and a
pair of arms 38 extending generally oppositely
from one another from the lower end of the post
30 36. Each arm 38 has at its end a related ground
engaging wheel 40.

 Each of the arms 38 comprises a pair of
elongate arm plates 42 which are spaced apart from

one another a short distance so that the wheel 40 can be mounted between the outer end portions of its related pair of arm plates 42, so that the wheel 40 can freely rotate about its axle 44.

5 With reference to Figures 3A and 3B, it can be seen that the two pair of arms 38 (made up of arm plates 42) are not diametrically opposed at a 180° angle. Rather, these two arms 38 are angled with respect to one another so that the interior angle
10 formed by these two arms 38 (i.e. the interior angle being that angle facing the pivot location 24 indicated at "b" in Figure 3B) is slightly less than 180°. This angle is selected so that the two axes of rotation 46 of the wheels 40 converge and
15 meet at the end pivot location 24. Thus, it can be seen that these wheels 40 are aligned so that as the apparatus 10 is rotated about the pivot location 24, these wheels 40 follow an arcuate path having the pivot location 24 as its center of
20 the arcuate path of travel.

It will be noted that at the top of the post 36 at the mobile end 26 of the lifting bar 20 there is mounted a rotatable wheel 48 having its axis of rotation perpendicular to the length of
25 the bar 20. Thus, as can be see in Figure 15, the apparatus 10 can be positioned to rest on the wheel 48 so that the apparatus 10 can easily be moved along the paved surface 33, with the wheel 48 providing ground support. Also an eyebolt 51
30 is connected to the mobile end 26 of the bar 20, so that this could be engaged to pull the mobile end laterally (see Figure 3B).

The bar 20 is conveniently made as two elongate plate members 50 spaced laterally from one another. The ends of the two elongate plates 50 are fixedly connected at one end to the post 28 and at the other end to the post 36 so that a substantially rigid bar 20 is formed. Also, at a location between the pivot post 28 and the lifting mechanism 18, there is provided a stabilizing post 52 which is fixedly mounted to the bar 20 by means of a mounting plate 54. This stabilizing post 52 has a lower end 56 positioned a short distance above the plane defined by the lower end 32 of the pivot post 28 and the lower surfaces of the pavement engaging wheels 40. the function of this stabilizing post 52 is to help position the manhole cover 12 as it is being lifted, and this will be described in more detail later herein.

The aforementioned lifting mechanism 18 is shown in this preferred embodiment as a screw jack or screw actuator. This lifting mechanism 18 comprises an elongate square housing 58 which is fixedly mounted by means of a plate 60 to the bar 50 at a mid-location along the bar 20 so that in the use position, as shown in Figure 1, the lifting mechanism 18 is centered on the manhole cover 12. At the lower end of the lifting mechanism 18 there is a lift attachment 62. Extending upwardly from the elongate housing 58 there is an actuating rod 64 formed at its upper end with an actuating crank 66. By rotating the crank 66, the lift attachment 62 can be raised or lowered.

The internal structure showing the screw drive of the lifting mechanism 18 is illustrated in Figure 14. There is a threaded actuating screw or drive member 68 which is fixedly attached at its upper end to a drive nut 70 that is mounted by a thrust bearing collar 72 at an upper end plate 74 of the elongate housing 58. This nut 70 attaches through a connecting portion 76 to an upper end of the drive screw 68. The rod 64 has at its lower end a flat sided head portion to engage the upper Allen's head opening 78 of the nut 70.

Positioned within the elongate housing 58 is an interior lifting member 80 having a square configuration and fitting snugly within what in cross section is the square shaped confines of the interior of the housing 58. This member 80 has an upper end portion 82 having a circular threaded opening that engages the threads of the actuating screw 68. Thus, rotation of the drive screw 68 in one direction or the other causing the lifting member 80 to be either raised or lowered.

The structure and functioning of the aforementioned connecting attachment 62 will now be described with reference to Figures 5 through 7. This connecting member 62 comprises two collet like fingers 84, each of which has in cross-section a nearly semi-circular configuration so as to have an outer curved surface 86. Each member 84 has a semi-circular expanded lip portion 88 at the bottom portion. The upper ends of the fingers 84 are fixedly connected to (or formed integrally with) respective mounting members 90 which have

interior openings 92 to receive a connecting pin 94. The connecting pin in turn connects to lower ears 96 of another connecting member 98. The member 98 has upper ears 100 with openings 102 to receive a connecting pin 104. The pin 104 connects to an intermediate loop-like link 106 that in turn connects by one of its loops to a pin 108 of an upper connector 110. The connector 110 fits within the lower open end of the lifting member 80 and has aligned through openings that match with openings in the member 80 so that a retaining pin 112 can be placed through the openings of the member 80 and the retaining member 110 to retain the connecting attachments 62 in place. The pin 112 has a retaining detente 114 at one end and at the there end a ring 116 by which it can be more easily removed and put back into place.

To describe the operation of this connecting attachment 62, it is first attached to the lifting member 80 as shown in Figure 6. With the apparatus 10 being at the position shown in Figure 1, the jack crank handle 66 is rotated to lower the connecting attachment 62 into the lift access opening 118 of the manhole cover 12. With the connecting attachment 62 positioned as shown in Figure 6, the bar 20 is moved a short distance laterally so that the upper part of the collet fingers 84 are accessible from immediately above the fingers 84. Then a positioning wedge 120 (see Figure 7) is pushed between the collet fingers 84 so as to spread these apart and into tight

gripping engagement with the surface of the manhole cover opening 118.

To describe the overall operation of the present invention, the apparatus 10 is assembled and put in its operating position as shown in Figure 1. The crank handle 66 is rotated to lower the lifting member 80 downwardly so that the fingers 84 of connecting attachment 62 moves into manhole cover opening 118. (For ease of illustration, the entire linkage of the connecting attachment 62 is not shown in Figure 1.) The collet fingers 84 of the connecting attachment 62 are spread apart as shown in Figure 7 so that these collet fingers 84 are in firm engagement with the sidewall of the opening of the manhole cover opening 118 and outwardly projecting lips 88 is firmly engaged with the underside of the vault cover.

In the position of Figure 1, the pivot post 28 and the post 36 of the mobile section 34 are on opposite sides of the manhole cover 12 and diametrically opposite one another relative to the circle defined by the manhole cover 12. The crank handle 66 is rotated in a direction to raise the lifting member 80 and thus lift the manhole cover 12 free of its support frame 14. If the manhole cover 12 is formed symmetrically, and if the manhole cover opening 18 is centrally located, then the manhole cover 12 will be lifted without much tilting. In the event the manhole cover 12 is weighted more to one side than the other so that there is some tilting, as can be seen in Figures 2A, 2B, and 2C, the apparatus can be

positioned so that the positioning post 52 is located at the part of the cover 12 that tends to be tilted upwardly. Thus, when the lifting member 80 continues to be raised, the cover 12 will be raised in a near level position, as shown in Figure 2C.

Reference is now made to Figure 3A and 3B. In Figure 3A, the cover 12 is shown having been lifted free of the manhole perimeter frame 14. Then the mobile end portion 26 of the apparatus 10 is pulled laterally as indicated by the arrow 121 in Figure 3B. To avoid any unwanted downward bending motion of the person operating the apparatus 12, it is a simple matter for the workman to take a T-bar hook, and move the hook to engage an eye-bolt 51 and pull the mobile end 26 of the bar 20 laterally and then pull the mobile end of the bar 20 laterally while the workman is in a more upright position.

When the manhole cover 12 has been moved away from over the manhole, the crank 66 can be rotated in the direction to lower the manhole cover so that it rests on the adjacent pavement 32, or it can remain suspended. In that instance, the wheels 40 may be blocked with a small wedge-like member to avoid unwanted movement.

In reviewing the overall operation of the present invention, it can be seen that the entire operation can be accomplished with the workman himself applying substantially no vertical forces. There is little lifting force is required, except possibly to maneuver the apparatus 10 into place. Also, there is no requirement to exert any

significant downward force, as is the case in a number of prior art devices which are designed to raise manhole covers. The only force which would be required is to use the arm to rotate the crank
5 66, and also to pull the mobile end 26 of the apparatus laterally. A review of the human dynamics involved in the entire operation of the apparatus 10 reveals that most (if not all) of the motions and apply forces exerted by the human body
10 which more likely result in a back injury (or other serious injuries) are, if not totally eliminated, at least substantially alleviated.

To discuss some of the other features of the present invention. In Figure 4A there is shown
15 the manhole cover 12 where there is a centrally located access lift opening 118. In Figure 4B, there is shown a manhole cover 12a having three openings 118a arranged in a triangular pattern, with the triangle being centered in the cover 12a.
20 In 4C, there is a cover 12b having a single access lift opening 118b which is off center and closer to the edge.

With the arrangement of Figure 4B, the cover 12a could be lifted as shown in Figure 2B with the
25 use of the positioning member 52. However, the manhole cover 12b is move difficult.

In order to lift the manhole 12b (shown in Figure 4C) so that it would remain substantially horizontal there is additionally provided, as
30 shown in Figures 8 and 9, an auxiliary lift bar 124. This bar 124 has an elongate mounting arm 126 having a plurality of spaced notches 128 along its lower edge. This arm 126 is connected to a

link, such as shown at 106, that is in turn
connected to the lifting member 80. The arm 126
is in turn rigidly connected to (or formed
integrally with) what can be functionally
5 described as a torquing member 130 which has a
rectangular configuration and a middle opening
132. At the outside end of the torquing member,
there is a threaded through opening 134 to receive
a threaded positioning rod 136 having a turning
10 handle 138. Instead of forming threads in the
opening 134, a threaded nut can be welded at the
opening 134 to position the rod 136. Also, the
torquing section 130 has a pair of aligned through
openings 140 to receive a pin, such as shown at
15 94, to mount the two collet fingers 84. The
wedging member 120 can thus be inserted through
the central opening 132 to spread the collet
fingers 84 apart and come into secure engagement
with the manhole cover opening 118b, or one of the
20 openings 118a.

To explain the operation of this auxiliary
arm 124, let us assume that the apparatus 10 is in
place (as illustrated in Figure 1,) and that the
lifting member 80 of the lift mechanism 18 is in
25 the position shown in Figure 9. As this lift
member 80 is raised, the collet fingers 84 will
lift the manhole cover 12b at the location of the
collet fingers 84. As the cover 12b is raised a
short distance, it will come into engagement with
30 its lower end 142 of the member 136. Further
raising of the lifting member 80 will thus raise
the entire cover 12b which would remain
substantially horizontal.

The reason for this is that the lifting force from the member 80 is applied at a central location in the manhole cover 12b. Because the lever arm between the location of the collet fingers 84 and the member 136 is rather short, in comparison with the distance from the collet fingers 84 to the center of the manhole cover, substantial vertical forces will be exerted by the collet fingers 84 and the rod 136. These in turn would cause a moment to be applied against the manhole cover 12b to raise the entire manhole cover as the lifting member 80 is raised.

Figures 10 and 11 show another type of manhole cover 12c where there is a grid-like cover 144 made up of a plurality of bars 146. In this instance, the lifting member 80 is simply provided with a hook member 148 to accomplish the lifting operation.

Figure 12 shows another type of manhole cover 12d where there is a cross finger 150 positioned in a recess 152 formed in the manhole cover 12d. The aforementioned hook 148 is connected to the lifting member 80 to lift this cover 12d. It is to be understood that the auxiliary lifting bar 124 (see Figures 8 and 9) could be used to accomplish this lifting motion, by connecting the hook member 148 to the pin 94 in the manner shown in Figure 9.

It is to be recognized that various modifications could be made from the present invention without departing from the basic teachings thereof.

What is Claimed

1. A lifting assembly arranged to lift an object which has a width dimension and is at least partially surrounded by a base surface which has a substantial horizontal alignment component, such as a manhole cover surrounded by a paved or ground surface, said assembly comprising:

- a. a base support assembly comprising;
 - i. a beam structure which has a lengthwise axis, is adapted to be positioned above the object, and has a length dimension greater than the width dimension of the object, said beam structure having a first pivot end and a second mobile end;
 - ii. a pivot support connected to the beam structure and located at the pivot end thereof, and arranged to support the pivot end of the beam structure from the base surface;
 - iii. a mobile support connected to the beam structure and located at the mobile end thereof, and arranged to support the mobile end of the beam structure from the base surface, said mobile support having mobile base surface engaging means to enable the

mobile support to be moved
laterally over the base
surface;

- 5 b. a lifting mechanism mounted to the
base support assembly and comprising
a lift connection to engage said
object and an actuating means to
lift said object

10 whereby said lifting assembly can be positioned
over said object with the pivot support being on
one side of said object and the mobile support
being on an opposite side of said object, so that
said lifting mechanism is able to raise said
15 object, and said lifting assembly can be moved
laterally so as to move said object.

2. The assembly as recited in claim 1,
wherein said pivot support is arranged to engage
said base surface in a manner to remain at a
substantially stationary base surface location
20 during movement of said lifting assembly

3. The assembly as recited in claim 2,
wherein the surface engaging means of the mobile
support is arranged to move in an arcuate path
having said stationary location of the pivot
25 support being at a center of said arcuate path.

4. The assembly as recited in claim 3,
wherein said surface engaging means comprises a
pair of base surface engaging wheels spaced on
opposite sides of the mobile end of the beam
30 structure.

5. The assembly as recited in claim 4,
wherein each of said wheels has an axis of
rotation, with the two axes of rotation converging

and meeting at substantially said location of the pivot support.

6. The assembly as recited in claim 2, wherein said pivot support comprises a post
5 extending downwardly from the pivot end of the beam structure, with a lower end of the post being adapted to engage the base surface.

7. The assembly as recited in claim 1, wherein said lifting mechanism comprises a lifting
10 jack mounted to said beam structure at an intermediate location between the pivot end and the mobile end of the beam structure.

8. The assembly as recited in claim 7, wherein said jack has a substantially vertical
15 lift axis, and said jack has a lifting member connecting at a lower end thereof to said lift connection, said jack having said actuating means to raise said lifting member relative to said beam structure.

9. The assembly as recited in claim 8, wherein said jack is a screw jack, comprising an
20 actuating screw vertically aligned in said jack, and further comprising manually operable crank means to turn said actuating screw.

10. The assembly as recited in claim 1, wherein said lift connection comprises a pair of
25 collet fingers adapted to be positioned in a lift opening of said object, and means to expand said collet fingers outwardly to come into gripping engagement with the surface of said lift opening.
30

11. The assembly as recited in claim 1, wherein there is an auxiliary lift bar which has an auxiliary lift connection to lift the object at

an off center connecting location spaced from a center of gravity of said object, said lift bar having a lifting mechanism connecting portion adapted to be located near a center of gravity of
5 said object and be connected to said lifting mechanism near said center of gravity, said auxiliary bar having a torque portion spaced from said center of gravity location, said torque portion having a torque member engaging said
10 object at a location spaced from said off center connecting location to apply a torque from said auxiliary arm to said object so that said object is lifted entirely from said base surface.

12. The assembly as recited in claim 11,
15 wherein said lifting mechanism connecting portion has adjustable connecting means whereby lift connection can be positioned at various distances from said center of gravity.

13. The assembly as recited in claim 1,
20 wherein said object is a manhole cover, and said base surface is a paved or ground surface adjacent to said manhole cover.

14. A method of lifting an object which has a width dimension and is at least partially
25 surrounded by a base surface which has a substantial horizontal alignment component, such as a manhole cover surrounded by a paved or ground surface, said method comprising:

- a. placing a base support assembly over
30 said object so that;
 - i. a beam structure of the support assembly is positioned above the object,

- 5 said beam structure having a
length dimension greater than
the width dimension of the
object, said beam structure
having a first pivot end and
a second mobile end;
- 10 ii. locating a pivot support which
is connected to the beam
structure and located at the
pivot end of the beam
structure on one side of the
object to support the pivot
end of the beam structure
from the base surface;
- 15 iii. locating a mobile support
connected to the beam
structure and located at the
mobile end thereof, and on
opposite sides of the object
to support the mobile end of
the beam structure from the
base surface, said mobile
support having mobile base
surface engaging means to
25 enable the mobile support to
be moved laterally over the
base surface;
- 30 b. using a lifting mechanism mounted to
the base support assembly to engage
said object by a lift connection and
utilize an actuating means of said
lifting mechanism to lift said
object;

c. moving said lifting assembly
laterally to move said object.

15. The method as recited in claim 14,
wherein said pivot support engages said base
5 surface at a substantially stationary base surface
location during movement of said lifting assembly.

16. The method as recited in claim 15,
wherein the surface engaging means of the mobile
support is moved in an arcuate path about said
10 stationary location of the pivot support as a
center of said arcuate path.

17. The method as recited in claim 16,
wherein said surface engaging means comprises a
pair of base surface engaging wheels spaced on
15 opposite sides of the mobile end of the beam
structure, and each of said wheels has an axis of
rotation, with the two axes of rotation converging
and meeting at substantially said location of the
pivot support.

20 18. The method as recited in claim 15,
wherein said pivot support comprises a post
extending downwardly from the pivot end of the
beam structure, with a lower end of the post being
adapted to engage the base surface.

25 19. The method as recited in claim 14,
wherein a lifting jack of said lifting mechanism
is mounted to said beam structure at an
intermediate location between the pivot end and
the mobile end of the beam structure and is used
30 to lift said object.

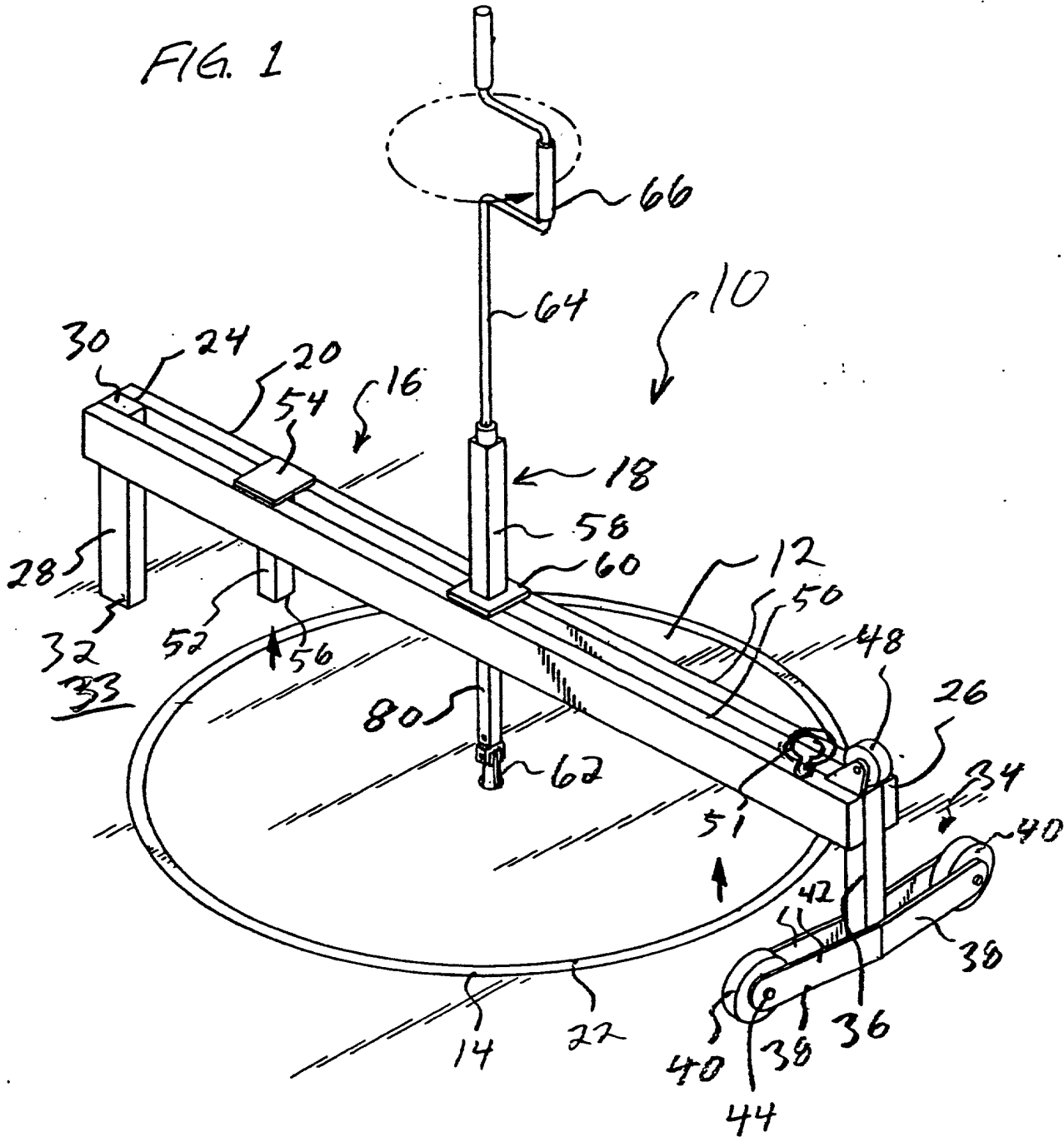
20. The method as recited in claim 14,
wherein said object is a manhole cover, and said

base surface is a paved or ground surface adjacent to said manhole cover.

Abstract of the Invention

- 5 A manhole lifting apparatus comprising a base support assembly and a lifting mechanism. There is a beam structure which extends over the manhole, with a pivot support at one end of the beam structure, and a mobile support at the
- 10 opposite end of the beam structure. The lifting mechanism is at the central part of the beam structure. The lifting mechanism lifts the manhole cover, and the support assembly is rotated about the pivot support to remove the manhole
- 15 cover from the manhole.

FIG. 1



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FIG. 2A

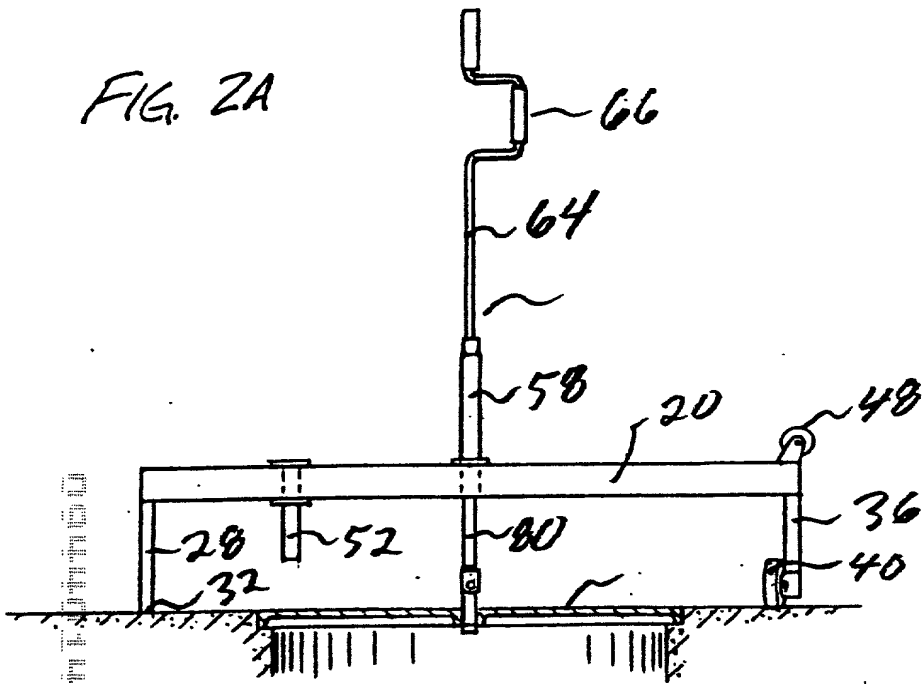


FIG. 2B

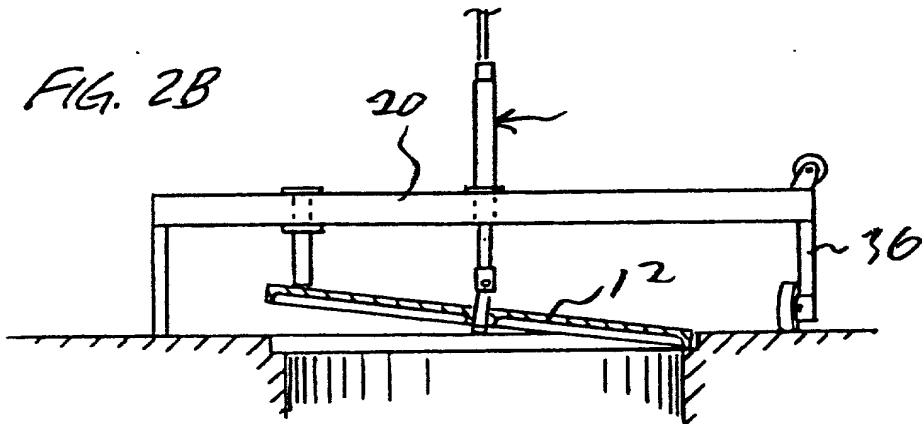
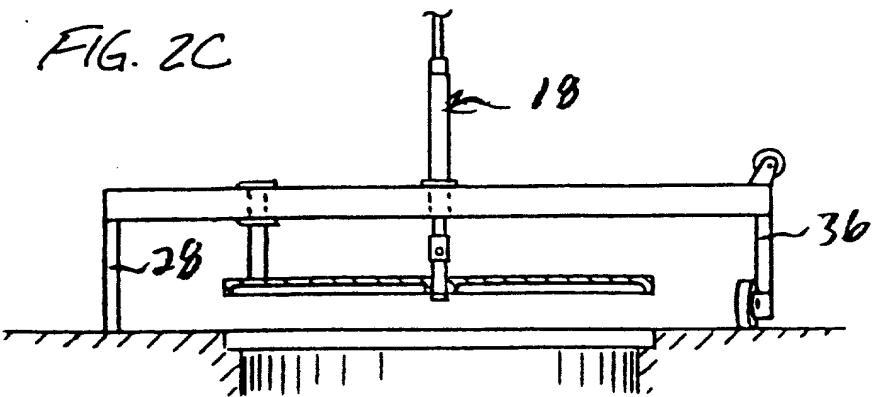


FIG. 2C



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FIG. 3A

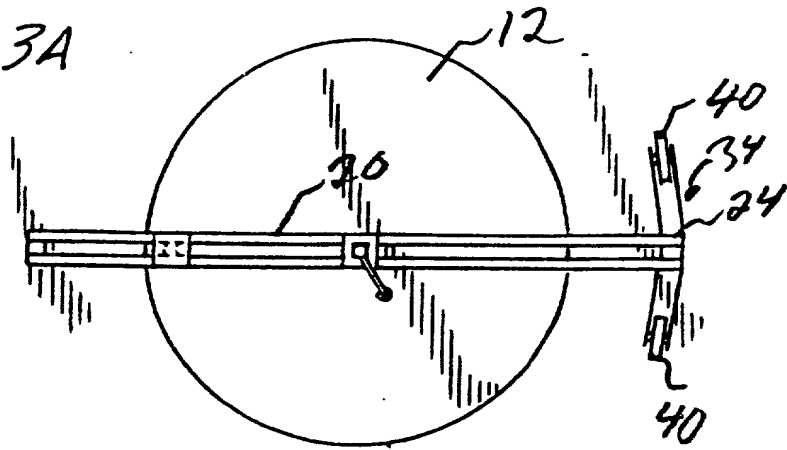


FIG. 3B

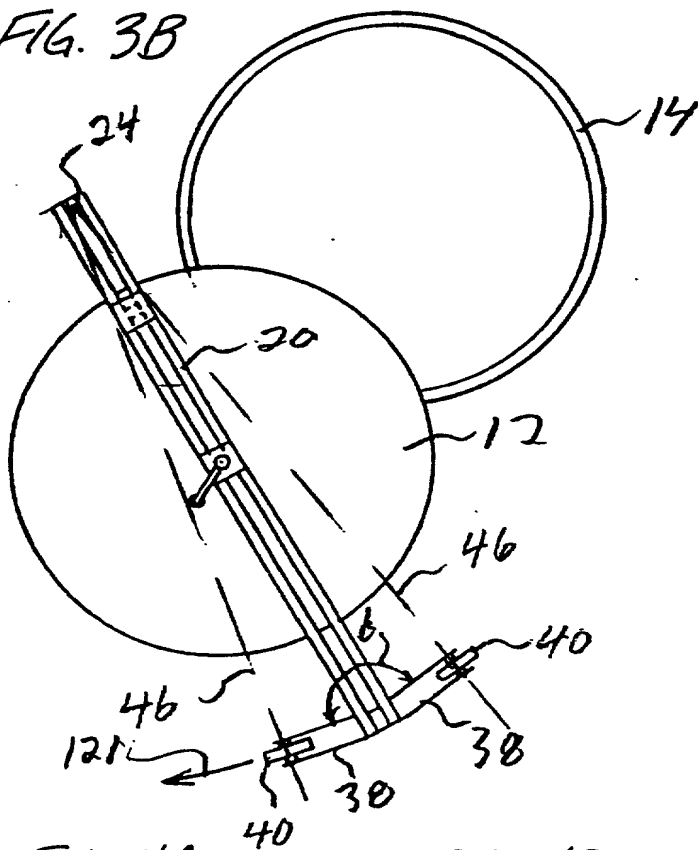


FIG. 4A

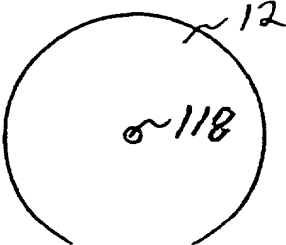


FIG. 4B

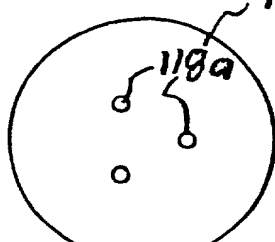


FIG. 4C



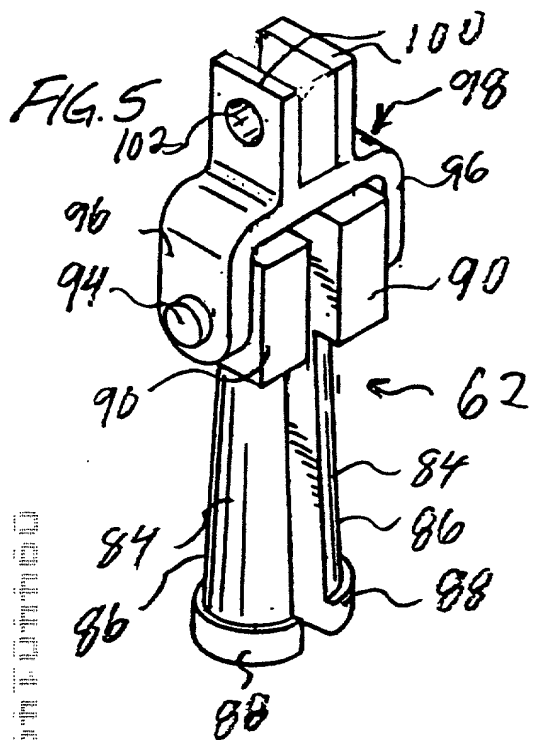


FIG. 6

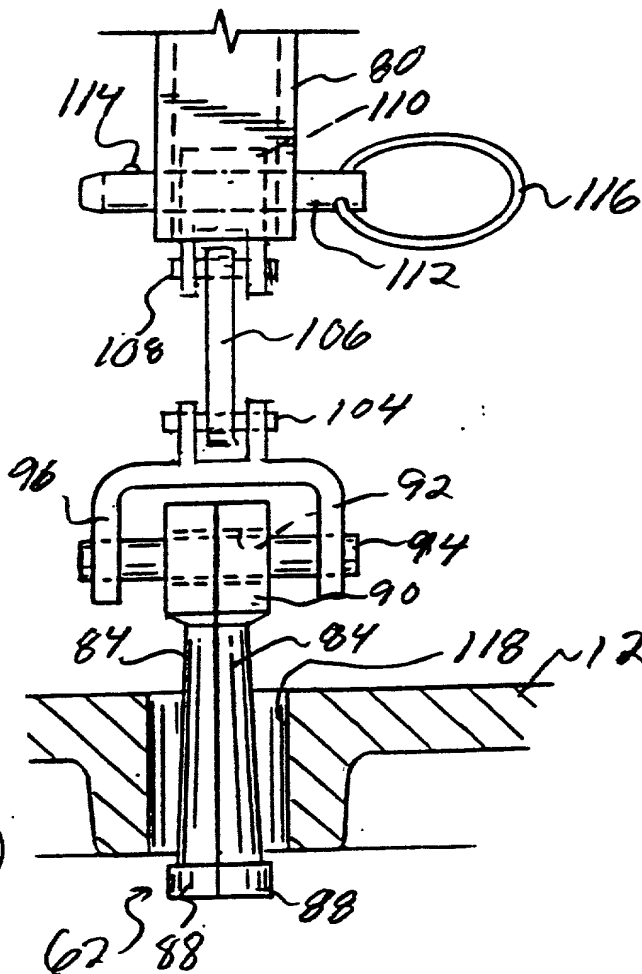
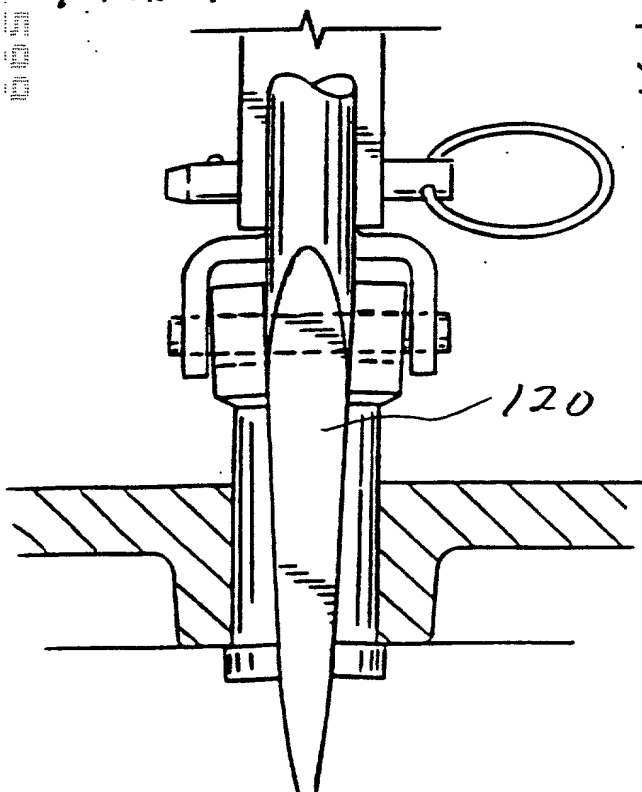
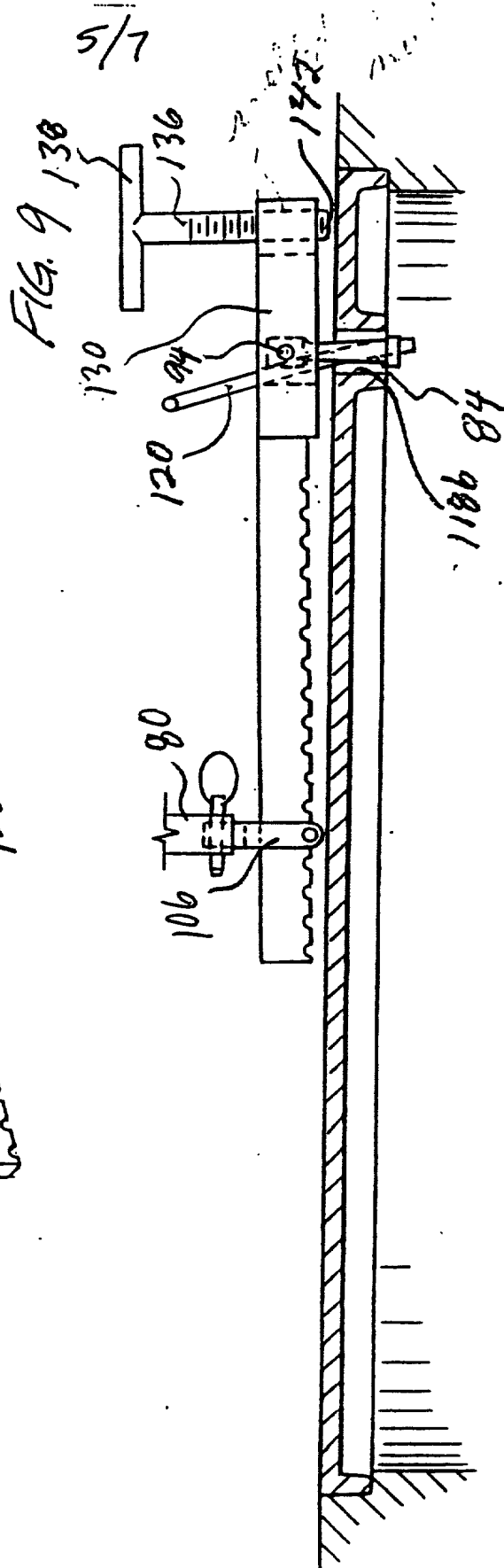
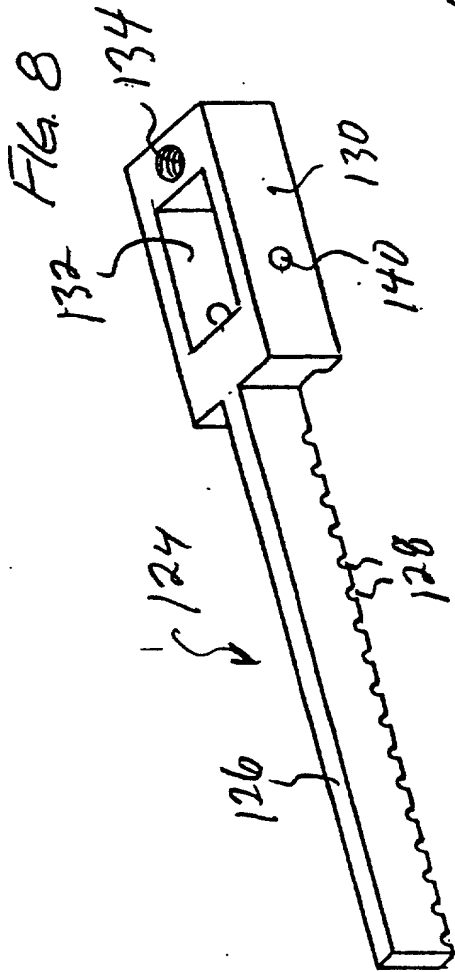
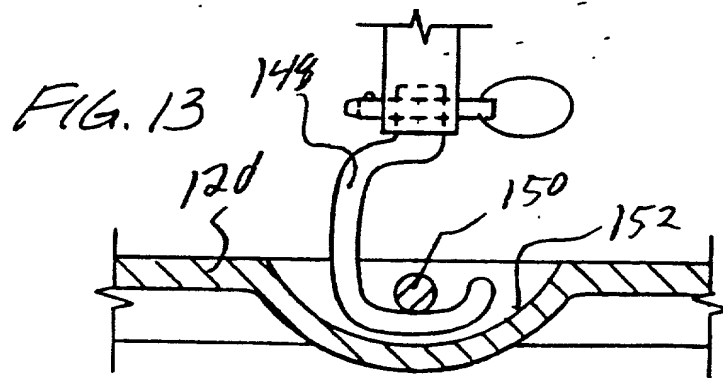
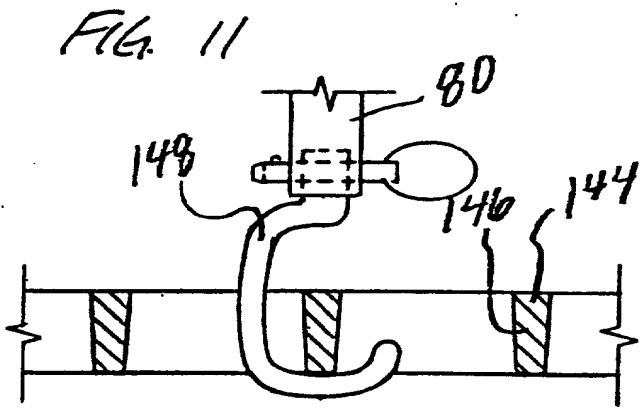
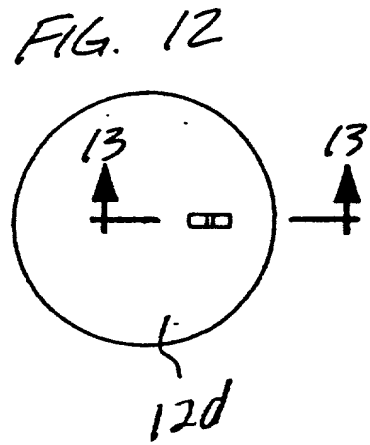
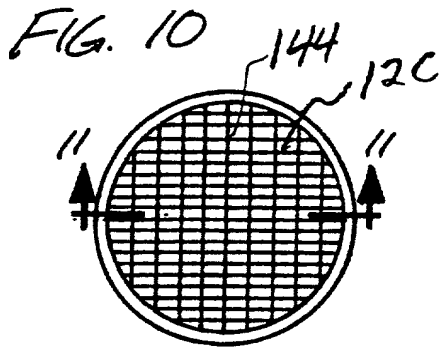


FIG. 7





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FIG. 14

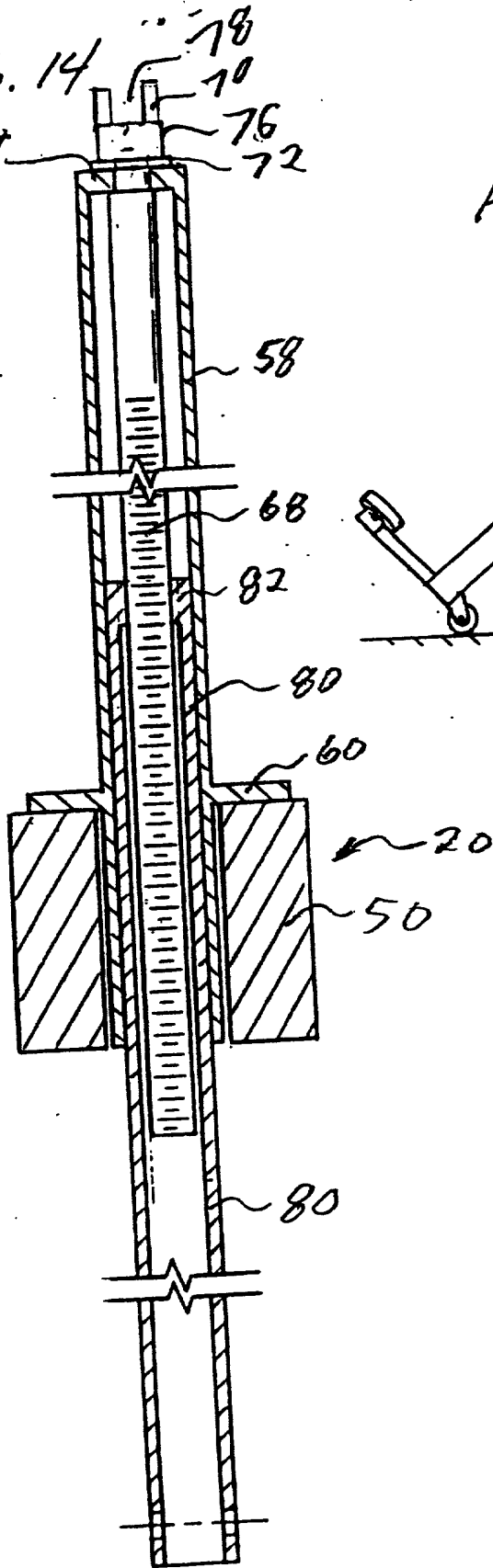
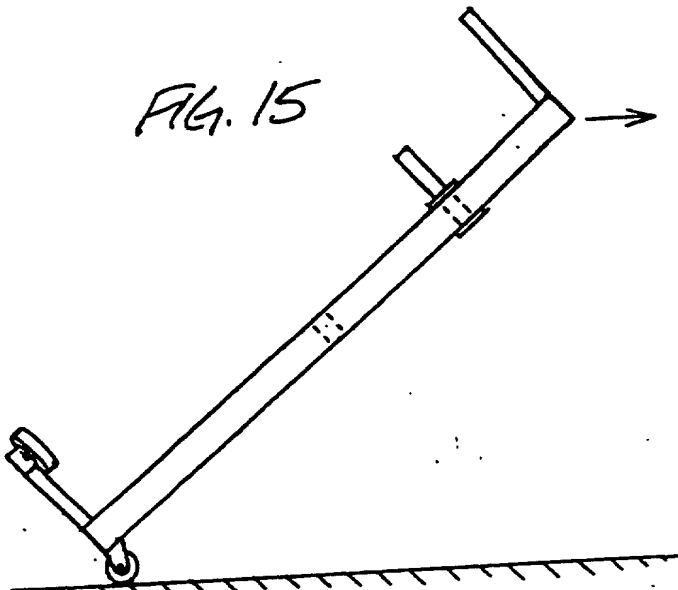


FIG. 15



PATENT

Attorney's Docket No. P3526

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,
CONTINUATION OR CIP)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: (check one applicable item below)

- ☒ original
☐ design
☐ supplemental

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application do not check next item; check appropriate one of last three items.

- ☐ national stage of PCT

NOTE: If one of the following 3 items apply then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR CIP.

- ☐ divisional
☒ continuation
☐ continuation-in-part (CIP)

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

MANHOLE COVER LIFTING APPARATUS AND METHOD

SPECIFICATION IDENTIFICATION

the specification of which: (complete (a), (b) or (c))

- (a) ☐ is attached hereto.
(b) ☒ was filed on _____ as ☐ Serial No. 0 / _____
or ☐ Express Mail No., as Serial No. not yet known EG545521036US
and was amended on _____ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO which contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

(Declaration and Power of Attorney [1-1]—page 1 of 4)

(c) ☐ was described and claimed in PCT International Application No. _____ filed on _____ and as amended under PCT Article 19 on _____ (if any).

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

☐ In compliance with this duty there is attached an information disclosure statement. 37 CFR 1.97.

PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

(d) ☐ no such applications have been filed.

(e) ☒ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. claimed priority check item (e), enter the details below and make the priority claim.

EARLIEST FOREIGN APPLICATION(S), IF ANY FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
U.S.	08/489,360	12 June '95	<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>

ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

Robert B. Hughes (19,304); Richard D. Multer (20,661);
and Michael R. Schacht (33,550)

(check the following item, if applicable)

- ☐ Attached as part of this declaration and power of attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

Robert B. Hughes
HUGHES, MULTER & SCHACHT, P.S.
1720 Iowa Street
Bellingham, WA 98226

DIRECT TELEPHONE CALLS TO:

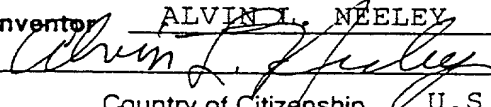
(Name and telephone number)

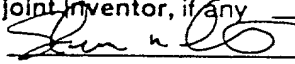
Robert B. Hughes
(206) 647-1296

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

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Date 1/4/96 Country of Citizenship U.S.
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Post Office Address 125 So. 309th Street
Federal Way, Washington 98003

CHECK PROPER BOX(ES) FOR ANY OF THE FOLLOWING ADDED PAGE(S) WHICH
FORM A PART OF THIS DECLARATION

- ☐ Signature for third and subsequent joint inventors. *Number of pages added* _____
- ☐ Signature by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added* _____
- ☐ Signature for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. *Number of pages added* _____

...

- ☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (CIP) application.
- ☐ Number of pages added _____

...

- ☐ Authorization of attorney(s) to accept and follow instructions from representative

...

If no further pages form a part of this Declaration then end this Declaration with this page and check the following item

- ☒ This declaration ends with this page